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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/544,129	08/02/2005	Satoshi Takei	124936	8585

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OLIFF & BERRIDGE, PLC
P.O. BOX 320850
ALEXANDRIA, VA 22320-4850

EXAMINER	
EOFF, ANCA	
ART UNIT	PAPER NUMBER
1795	
MAIL DATE	DELIVERY MODE
12/04/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/544,129	TAKEI ET AL.	
	Examiner	Art Unit	
	ANCA EOFF	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 August 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2 and 4-10* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2 and 4-10* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. The foreign priority document JP 2003-044045, filed on February 21, 2003 was received and acknowledged. However, in order to benefit of the earlier filing date, a certified English translation is required.

2. Claims 1, 2 and 4-10 are pending in the application. Claim 3 is canceled.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1, 2, 4-6 and 8-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takei et al. (WO 02/05035, wherein the citations are from the English equivalent document, US Pg-Pub 2003/0146416).

With regard to claims 1, Takei et al. disclose a composition for forming a gap-filling material for lithography, wherein said material is used for producing semiconductor devices by a method using the gap filling material to apply the resist on a substrate having holes with an aspect ratio of 1 or more, to transfer images onto the substrate by utilization of lithographic process (abstract). The composition for forming a gap-filling material comprises a polymer, a solvent (abstract) and a crosslinking agent (par.0095).

Takei et al. further disclose that the polymer is preferably a polymer that contains at least one or more hydroxyl groups per repeating unit and examples thereof include polymers obtained by polymerizing compounds such as hydroxyalkyl acrylates or hydroxyalkyl methacrylates (par.0061).

As hydroxyalkyl acrylates, Takei et al. specifically disclose : hydroxyethyl acrylate (equivalent to the compound of formula (1) of the instant application, wherein R_1 is a hydrogen atom, p=1, q=0 and R_2 is a hydrogen atom), hydroxypropyl acrylate (equivalent to the compound of formula (1) of the instant application, wherein R_1 is a hydrogen atom, p=2, q=0 and R_2 is a hydrogen atom) and hydroxybutyl acrylate (equivalent to the compound of formula (1) of the instant application, wherein R_1 is a hydrogen atom, p=3, q=0 and R_2 is a hydrogen atom) (par.0064).

As hydroxyalkyl methacrylates, Takei et al. specifically disclose hydroxyethyl acrylate (equivalent to the compound of formula (1) of the instant application, wherein R_1 is a methyl group, p=1, q=0 and R_2 is a hydrogen atom), hydroxypropyl acrylate (equivalent to the compound of formula (1) of the instant application, wherein R_1 is a methyl group, p=2, q=0 and R_2 is a hydrogen atom), hydroxybutyl acrylate (equivalent to the compound of formula (1) of the instant application, wherein R_1 is a methyl group, p=3, q=0 and R_2 is a hydrogen atom) (par.0065).

Takei et al. further disclose that the weight average molecular weight of the polymer is preferably between 1,000 and 30,000 (par.0060). If the weight average molecular weight of the polymer is less than 1,000, it is difficult to obtain a film in an

amorphous state and polymers with weight average molecular weight of more than 30,000 do not meet the viscosity requirements (par.0060).

Takei et al. do not specifically disclose a polymer comprising only units derived from the hydroxyalkyl (meth)acrylates mentioned above and having the weight molecular weight in the range of 5,000 to 20,000. However, it would have been obvious to one of ordinary skill in the art at the time of the invention to obtain such a polymer, based on Takei's teachings that polymers comprising at least one hydroxyl group per repeating unit may be obtain by polymerizing hydroxyalkyl (meth)acrylates (par.0061). Further, Takei's teaching regarding the preferred weight average molecular weight of the polymers (par.0060).

The range of the weight average molecular weight between 1,000 and 30,000 encompasses the range for molecular weight of the instant application.

In Synthetic Examples 2 and 3 (par.0019 and par.0123), Takei et al. disclose polymers having weight average molecular weights of 5,300 and respectively 19,000 so one of ordinary skill in the art at the time of the invention would have been motivated to obtain polymers with weight average molecular weights in this range. Such polymers would satisfy the limitation of "containing components having a molecular weight of 3,000 or less in a rate of 20% or less".

With regard to claim 2, Takei et al. disclose a composition for forming a gap-filling material for lithography, wherein said material is used for producing semiconductor devices by a method using the gap filling material to cover the resist on a substrate having holes with an aspect ratio of 1 or more, to transfer images onto the substrate by

utilization of lithographic process (abstract). The composition for forming a gap-filling material comprises a polymer, a solvent (abstract) and a crosslinking agent (par.0095).

Takei et al. further disclose that the polymer is preferably a polymer that contains at least one or more hydroxyl groups per repeating unit and examples thereof include thermoplastic polymers obtained by polymerizing compounds such as hydroxyalkyl acrylates or hydroxyalkyl methacrylates (par.0061).

As hydroxyalkyl acrylates, Takei et al. specifically disclose hydroxyethyl acrylate (equivalent to the compound of formula (1) of the instant application, wherein R_1 is a hydrogen atom, p=1, q=0 and R_2 is a hydrogen atom), hydroxypropyl acrylate (equivalent to the compound of formula (1) of the instant application, wherein R_1 is a hydrogen atom, p=2, q=0 and R_2 is a hydrogen atom), hydroxybutyl acrylate (equivalent to the compound of formula (1) of the instant application, wherein R_1 is a hydrogen atom, p=3, q=0 and R_2 is a hydrogen atom) (par.0064).

As hydroxyalkyl methacrylates, Takei et al. specifically disclose hydroxyethyl acrylate (equivalent to the compound of formula (1) of the instant application, wherein R_1 is a methyl group, p=1, q=0 and R_2 is a hydrogen atom), hydroxypropyl acrylate (equivalent to the compound of formula (1) of the instant application, wherein R_1 is a methyl group, p=2, q=0 and R_2 is a hydrogen atom), hydroxybutyl acrylate (equivalent to the compound of formula (1) of the instant application, wherein R_1 is a methyl group, p=3, q=0 and R_2 is a hydrogen atom) (par.0065).

Takei et al. further disclose that the above-mentioned polymer can be copolymerized with an uncrosslinkable monomer, so that the dry-etching speed and

reflectivity can be finely adjusted and such co-polymerizable monomer includes alkyl acrylates and alkyl methacrylates having alkyl groups of 1 to 10 carbon atoms (par.0071 and par.0073-0074).

Takei et al. further disclose that the weight average molecular weight of the polymer is preferably between 1,000 and 30,000 (par.0060). If the weight average molecular weight of the polymer is less than 1,000, it is difficult to obtain a film in an amorphous state and polymers with weight average molecular weight of more than 30,000 do not meet the viscosity requirements (par.0060).

While Takei et al. do not specifically disclose a polymer comprising only units derived from the hydroxyalkyl (meth)acrylates and the alkyl (meth)acrylates and having the wieight molecular weight in the range of 5,000 to 20,000, it would have been obvious to one of ordinary skill in the art at the time of the invention to obtain such a polymer, based on Takei's teachings that polymers comprising at least one hydroxyl group per repeating unit may be obtain by co-polymerizing hydroxyalkyl (meth) acrylates (par.0061) with uncrosslinkable monomers, such as alkyl (meth) acrylates in order to finely adjust the reflectivity and dry etching speed (par.0071) and Takei's teaching regarding the preferred weight average molecular weight of the polymers (par.0060).

Takei et al. further disclose that the repeating unit which comprises a hydroxyl group may represent 20-80% of the repeating units of the polymers (par.0090-0093) and gives examples wherein the repeating unit which comprises a hydroxyl group represents 70% molar (par.0016) and respectively 49% molar (par.0120).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to obtain polymer comprising a repeating unit containing a hydroxyl group in an amount preferably between 20-80% of the repeating units of the polymer, wherein the repeating unit containing a hydroxyl group may be hydroxyalkyl (meth) acrylates.

In Synthetic Examples 2 and 3 (par.0019 and par.0123), Takei et al. disclose polymers having weight average molecular weights of 5,300 and respectively 19,000. Therefore, one of ordinary skill in the art at the time of the invention would have been motivated to obtain polymers with weight average molecular weights in this range. Such polymers would satisfy the limitation of "containing components having a molecular weight of 3,000 or less in a rate of 20% or less".

With regard to claims 4-5, Takei et al. disclose that the solvent used for the composition for forming gap-filling material preferably has a boiling point in the range of 145-220°C (par.0098) and may be butyl lactate, cyclohexanone, propylene glycol monobutyl ether or propylene glycol monomethyl ether acetate (par.0097).

With regard to claim 6, Takei et al. disclose that the crosslinker used for the composition for forming gap-filling material has at least two cross-linking forming functional groups (par.0095).

With regard to claims 8-10, Takei et al. disclose a semiconductor device manufacturing method comprising the following steps:

-a step (A) in which the composition for gap-filling material is applied to a substrate having holes with an aspect ratio or 1 or above and then is dried to form a planarized filling layer on the substrate (par.0107);

- a step (B) in which the resist is applied and dried (par.01018), and

- a step (C) in which an exposure and development are performed (par.0109).

Takei et al. also disclose that a bottom anti-reflective coating can be formed before or after the formation of the filling layer using the composition for forming gap-filling material in the above step (A) (par.0109).

5. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Takei et al. (WO 02/05035, wherein the citations are from the English equivalent document, US Pg-Pub 2003/0146416) as applied to claim 1 above and in further view of Rutter et al. (US Pg-Pub 20020110665).

With regard to claim 7, Takei et al. teach the composition for forming a gap-filling material of claim 1 (see paragraph 4 of the Office Action) but fail to teach that the composition comprises an acid or an acid generator.

Rutter et al. disclose an aperture fill material, comprising a cross-linkable polymer with hydroxyl groups, one or more crosslinking agents, one or more acid catalysts and a solvent (par.0026).

The acid catalysts are added to the composition to catalyze the crosslinking of the polymer and crosslinking agent (par.0051) and may be free acids or acid generators.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to include the acid catalysts (free acid or acid generators) disclosed by Rutter et al. in the composition for forming a gap-filling material of Takei et al., in order to catalyze the crosslinking of the polymer and crosslinking agent.

Terminal Disclaimer

6. The terminal disclaimer filed on August 18, 2008 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of any patent issued from co-pending application 10/540,389 has been reviewed and is accepted. The terminal disclaimer has been recorded.

Response to Arguments

7. The rejection of claim 2 under 35 USC 112-2nd paragraph is withdrawn following the applicant's amendment to claim 2.

The rejection of claims 1-2 and 6 under 35 U.S.C. 102(b) over Sono et al. (GB 1 496 345) is withdrawn following the applicant's amendment to claim 1.

8. Applicant's arguments filed on August 18, 2008 have been fully considered but they are not persuasive.

On page 7 of the Remarks, the applicant argues that Takei et al. disclose a gap filling material having a polymer that contains at least 1 or more hydroxyl groups, such as hydroxyalkylacrylates and hydroxyalkyl methacrylates (par.0061 and par.0063-0069) but includes hydroxyethyl acrylate and hydroxypropyl acrylate as two of 53 possible

polymers. The applicant further argues that Takei et al. disclose a number of possible polymer that is too large to support a case of obviousness.

The examiner respectfully disagrees. Takei et al. clearly disclose that hydroxyalkyl acrylates and hydroxyalkyl methacrylates are preferably used as polymers with at least 1 or more hydroxyl groups (par.0061) and specifically teaches hydroxyethyl acrylate and hydroxypropyl acrylate as hydroxyalkyl acrylates (par.0064) and hydroxyethyl methacrylate and hydroxypropyl methacrylate as hydroxyalkyl methacrylates (par.0065).

Takei et al. further disclose that hydroxystyrene-based polymers, cellulose polymers, crotonic acid-based polymers and phenolic resins may also be used as polymers with at least 1 or more hydroxyl groups (par.0061, par.0066-0069) but it would have been obvious to one of ordinary skill in the art at the time of the invention to obtain polymers of hydroxyethyl acrylate, hydroxypropyl acrylate, hydropxybutyl acrylate, hydroxyethyl methacrylate, hydroxypropyl methacrylate, hydroxybutyl methacrylate as being clearly disclosed by Takei et al. in par.0061, 0064, 0065.

In response to the applicant's argument that the fact that Takei et al. disclose 53 possible polymer compounds and one of ordinary skill in the art would not have been motivated to choose 4 polymer compounds out of the 53 disclosed, the examiner would like to show that one of ordinary skill in the art would have been motivated to obtain the polymer comprising only the monomer (1) of the instant application, based on Takei's teachings regarding the preferred compounds for polymer with 1 or more hydroxyl

groups (par.0061) and the specific disclosure of the preferred compounds (par.0064-0065).

The key to supporting any rejection under 35 U.S.C. 103 is the clear articulation of the reason(s) why the claimed invention would have been obvious. The Supreme Court in KSR noted that the analysis supporting a rejection under 35 U.S.C. 103 should be made explicit. The Court quoting In re Kahn, 441 F.3d 977, 988, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006), stated that "[R]ejections on obviousness cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.'" KSR, 550 U.S. at___, 82 USPQ2d at 1396. Exemplary rationales that may support a conclusion of obviousness include:

(A) Combining prior art elements according to known methods to yield predictable results;

(B) Simple substitution of one known element for another to obtain predictable results;

(C) Use of known technique to improve similar devices (methods, or products) in the same way;

(D) Applying a known technique to a known device (method, or product) ready for improvement to yield predictable results;

(E) " Obvious to try " – choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success;

(F) Known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art;

(G) Some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention. (MPEP 2100).

On page 8 of the Remarks, the applicant argues that Takei et al. teach a gap-filling material comprising polyhydroxystyrene (Examples 1 and 2) and polyhydroxypropylmethacrylate with a weight average molecular weight of 130,000 (Comparative Example 3), which shows poor results (Table 1).

The examiner would like to show the following: in par.0060, Takei et al. clearly teach that the polymer of the gap-filling material should have a weight average molecular weight between 1,000 to 30,000 and teaches that polymer with a weight average molecular weight over 30,000 rarely meet the viscosity requirement.

In Comparative Example 3, Takei et al. use a polyhydroxypropylmethacrylate with a weight average molecular weight of 130,000, which leads to poor results (Table 1) and has extremely high viscosity comparative to other polymers used for gap-filling material (Table 2).

The examiner considers that Comparative Example 3 is only proving that polymers with a weight average molecular weight outside the range of 1,000 to 30,000 are not satisfactory for gap-filling materials.

On pages 8-9 of the Remarks, the applicant argues that Takei et al. do not teach or suggest a polymer composed of the units (1) and (2) of the instant application, wherein the unit (1) is in a ratio of 0.40-0.95, as claimed in claim 2.

However, the examiner would like to show that Takei et al. clearly teach a polymer for gap-filling material having a weight average molecular weight preferably between 1,000 and 30,000 (par.0060) and being obtained by polymerization of an ethylenicall unsaturated compound with hydroxyl groups, such as hydroxylalkyl acrylates, hydroxyalklyl methacrylates (par.0061, 0064-0065), which are equivalent to the unit (1) of the instant application. Takei et al. further disclose that the polymer may comprise an unit from an acrylate or methacrylate unit, which are added in order to adjust the dry etching speed and the reflectivity (par.0071). The acrylates and methacrylates units are specifically taught in par.0073-0074 and are equivalent to the unit (2) of the instant application.

Therefore, one of ordinary skill in the art would be motivated to obtain a polymer comprising units (1) and (2), based on Takei's teachings in the above-mentioned paragraphs 0060, 0061, 0064-0065, 0071, 0073-0074.

On page 9, the applicant argues that Rutter et al. does not teach or suggest the gap fill material of claim 1. The examiner would like to point out that Rutter et al. was only relied upon to show that an aperture fill material may comprise not only a polymer with hydroxyl groups and one or more crosslinking agents but also an acid catalyst, which catalyzes the crosslinking of the polymer and crosslinking agent.

Conclusion

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ANCA EOFF whose telephone number is (571)272-9810. The examiner can normally be reached on Monday-Friday, 6:30 AM-4:00 PM, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Cynthia H. Kelly can be reached on 571-272-1526. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/A. E./
Examiner, Art Unit 1795

/Cynthia H Kelly/
Supervisory Patent Examiner, Art Unit 1795